KMW70

Water cooler for PXScanner and SuperNova systems

User Manual

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Important Information

This user manual applies to the KMW70 Water Cooler, which is manufactured in Poland by Agilent Technologies.

Product: KMW70 Water Cooler

Product No. CN-00-00-000

Electrical Ratings: 1/N AC 88-264 V 50/60 Hz

Before attempting to operate the system, PLEASE READ THE INSTRUCTIONS.

This product should only be used by persons legally permitted to do so.
If the equipment is used in a manner not specified in the User Manual, the protection provided by the equipment may be impaired.

Important Health and Safety Notice

When returning components for service or repair it is essential that the item is shipped together with a signed declaration that the product has not been exposed to any hazardous contamination or that appropriate decontamination procedures have been carried out so that the product is safe to handle.

Care has been taken to ensure the information in this manual is accurate and at an appropriate level. Please inform Agilent Technologies if you have any suggestions for corrections or improvements to this manual.

Nova service and support is available for technical and operational issues as indicated below.

- **E-mail**: XRDSupport@agilent.com
- **Phone**: +44 (0)1865 291600 between 8 a.m. and 4.30 p.m. (UK time), Monday to Friday
- **Fax**: +44 (0)1865 291601

This users' manual has been written according to standard 89/392/EEC and further modifications.

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1. Safety Information

In normal operation the unit is designed to operate safely. All users of the KMW70 Water Cooler unit should be aware of potential hazards which exist in and around equipment of this type and the ways of avoiding possible injury and equipment damage which may result from inappropriate ways of working. A description of such potential hazards and how to avoid them is given in this section.

1.1 Electrical safety

In normal use the user is protected from the dangers associated with the voltage, current and power levels used by the equipment. Only suitably qualified personnel should attempt to disconnect, dismantle or modify the equipment.

WARNINGS

Follow local and national electrical regulations and procedures.

Do not defeat interlocks, remove connectors, disconnect equipment, open safety covers, dismantle or modify equipment unless you are qualified and authorised to do so and you are fully conversant with its operation and potential hazards or have total assurance through your local electrical permit to work system that the equipment has been made safe.

Make sure that the mains supply is fused at an appropriate rating and that it can be isolated locally via a clearly labelled, clearly visible and easily accessible isolating switch. Isolate the supply before carrying out any maintenance work.

1.1.1 First Aid

WARNING

Do not attempt to administer first aid to someone who may have suffered electric shock until the source of the shock has been isolated.
Mains voltages are present in the system. High voltages are used by the X-ray tube and power supply. These can cause serious injury or death.
Only personnel qualified to work with high voltages and currents should perform service or maintenance work on such equipment.

1.2 Mechanical handling

The unit is heavy and requires careful handling. Use safe lifting procedures for heavy items to prevent possible strain injury.

1.3 Modifications and service

The manufacturer will not be held responsible for the safety, reliability or performance of the equipment unless assembly operations, extensions, re-adjustments, modifications and repairs are carried out only by persons authorised by the manufacturer. It should be stressed that those parts of the equipment which are interchangeable, and which are subject to deterioration during operation, may significantly affect the safety of the equipment.

2. Introduction

This manual applies to the KMW70 Water Cooler produced by Agilent Technologies.

2.1 Overview

The KMW70 Water Cooler has been designed to operate with the Nova microfocus X-ray source from Agilent Technologies, which is described in a separate manual.

2.2 Water-to-air and water-to-water modes

The KMW70 Water Cooler device can work with water-to-air or water-to-water heat exchangers. To transfer the unit from one mode to another some extra parts are required. They can be purchased from Agilent Technologies and will require assembly by an Agilent Technologies engineer.

The KMW70 Water Cooler in water-to-air operation requires an external Air Cooler (see Fig. 1a). This device transfers the heat to the environment and does not require an external (ie.tap) water supply.

While operating in water-to-water mode the device contains a water Reservoir (see Fig. 1b) on the left-hand side of the electronic rack. It also needs an external water supply (tap water, integrated building water circuit or additional water chiller, such as Thermoflex 900) to cool the device.

2.3 Environmental parameters

The KMW70 Water Cooler is designed to operate indoors. In water-to-water mode the air must have a temperature below 25 deg C. Sufficient air conditioning must be installed in the room to ensure the correct air temperature.

To fill the KMW70 reservoirs use 1:10 solution of distilled water with glycol to prevent the liquid and circuits from algae growth.

Water-to-air Configuration

KMW70 Chiller Unit	
Power connection	1/N AC 88-264V, 50/60Hz
Maximum power consumption	700W
Maximum mains current	2.7A (230V)
Fuse	T 3.15A/230V (T 6.3A/110V)
Ground terminal	Yes
Temperature stability	± 0.1 °C
Coolant specification	90% distilled water and 10% ethylene glycol
Internal reservoir volume	2 litres
Weight	20 kg
Dimensions	53 x 49 x 14 cm
AirCooler Radiator	
Power connection	1/N AC 110/230V, 50/60Hz
Maximum power consumption	80W
Fuse	T 1A/230V (T 2A/110V)
External air temperature	<25°C
Internal circuit pressure	0.3 bar
Weight	25 kg
Dimensions	75 x 32 x 93 cm
Proximity of AirCooler radiator and KMW70 unit	Up to 10m
Coolant specification	90% distilled water and 10% ethylene glycol
Coolant volume	3 litres

Water-to-water Configuration

KMW70 Chiller Unit	
Power connection	1/N AC 88-264V, 50/60Hz
Maximum power consumption	800W
Maximum mains current	2.8A (230V)
Fuse	T 3.15A/230V (T 6.3A/110V)
Ground terminal	Yes
Temperature stability	± 0.1 °C
Air temperature	<30°C
Internal circuit coolant specification	90% distilled water and 10% ethylene glycol
Internal circuit coolant volume	3L
External water temperature	<25°C
External water pressure	3 bar
Return line pressure (where required)	<2 bar (ideally <1 bar, for pressure drop of 2-3 bar between supply and return)
Weight	20 kg
Dimensions	53 x 49 x 14 cm

Table 1 KMW70 Water Cooler parameters for water-to-air and water-to-water mode

2.4 Two modules

The KMW70 Water Cooler contains two identical modules mounted in the left-hand and right-hand sides of the single enclosure. The left-hand module is labelled X-ray source and is intended to supply cooling water to the Nova X-ray source and the right-hand module is labelled CCD detector and is intended to supply cooling water to any of the Agilent Technologies CCD detectors.

The operation of the two modules has some differences. The CCD module has a mains voltage output (W2) on the rear panel to power the CCD detector only when cooling water is flowing normally. There is no mains output for the X-ray source module. The X-ray source module has an output connector (W5) on the rear panel to send a signal to confirm its normal operation (for use as an interlock signal with an X-ray generator unit). This signal refers only to the operation of the X-ray source module and NOT the operation of the CCD module. The internally set operating temperature for the water in the internal circuit through the X-ray source will normally be different from that in the CCD detector.

2.5 The Air Cooler and the Reservoir

The Air Cooler is the external heat exchanger for the KMW70 Water Cooler (see Fig. 1a). It contains a water reservoir with a water pump, a set of pipes, air vents, temperature and a level sensor. The heat of delivered water is being returned to the air.

The KMW70 Water Cooler working in water-to-water mode contains a water reservoir, a pump and two level sensors. This set of equipment is mounted on the left-hand side of the system (see Fig.1b). The heat of delivered water is being returned to the external water circuit.

Both water reservoirs should be filled with liquid to operate properly. The recommended coolant solution is 90% distilled water and 10% glycol. The filling ports are located on top of the devices.

a)

b)

Figure 1 Photograph of the Air Cooler (a) and the Reservoir (b)

2.6 Operating principles

Each module is connected to two separate water circuits: external and internal. The external one, in case of water-to-air mode, is connected to the Air Cooler. If the KMW70 Water Cooler operates in water-to-water mode, the external circuit is connected to the external water supply. The internal water circuit is connected to the devices to be cooled. The two circuits do not exchange water – they are connected to each other only by a heat transfer device. During start-up, if the internal circuit has insufficient water (even totally dry), it will be automatically filled with water taken from the reservoir.

Each module separately pumps water around the internal circuit. The temperature of water in that circuit is controlled within limits (set by internal software) and when needed the heat transfer device cools the internal circuit and delivers the heat into the external circuit.

3. Installation

This unit is built within a 19 inch rack-mounted enclosure of height 3U.

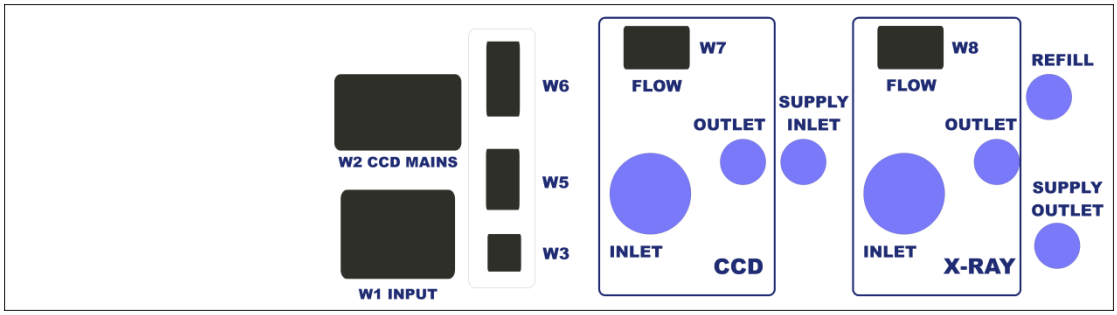


Figure 2 Rear panel of KMW70 Water Cooler

3.1 Electrical services

This unit should be supplied with mains voltage in the range 88-264 volts 50/60 Hz (on connector number W1).

3.2 Interfacing to external devices

Before connecting or disconnecting any cables on this unit it should be disconnected from the mains voltage supply.

3.2.1 External water circuit

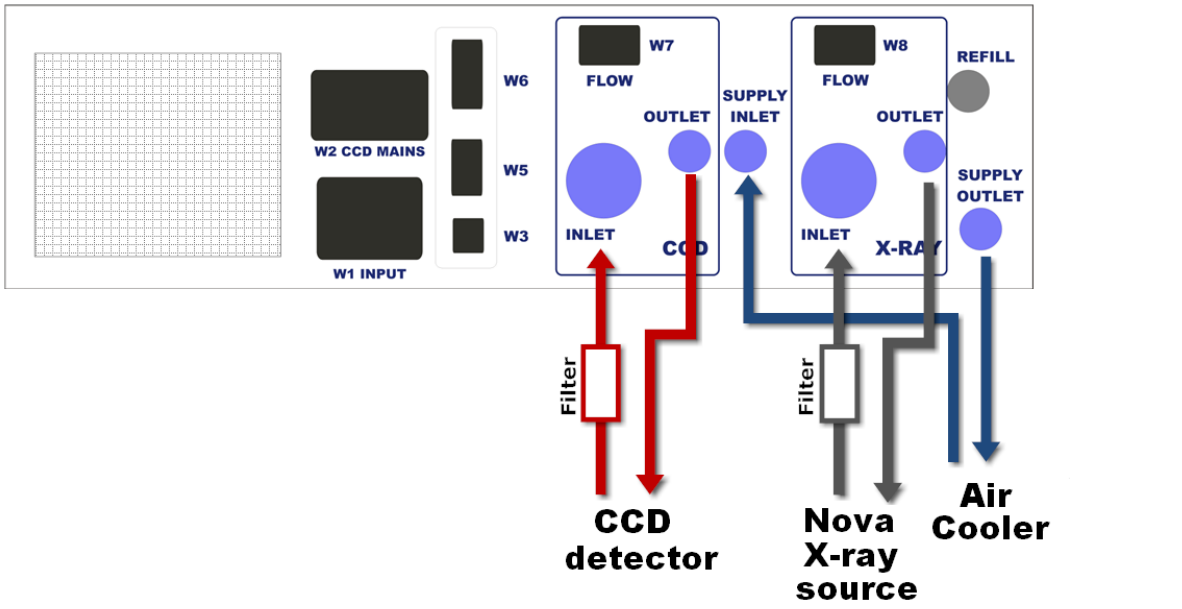
The rear panel of the unit contains supply water inlet and outlet points. Hoses should be pushed onto these points and secured with jubilee clips. It is important to ensure that the direction of water flow is correct.

- **Water-to-air mode:**

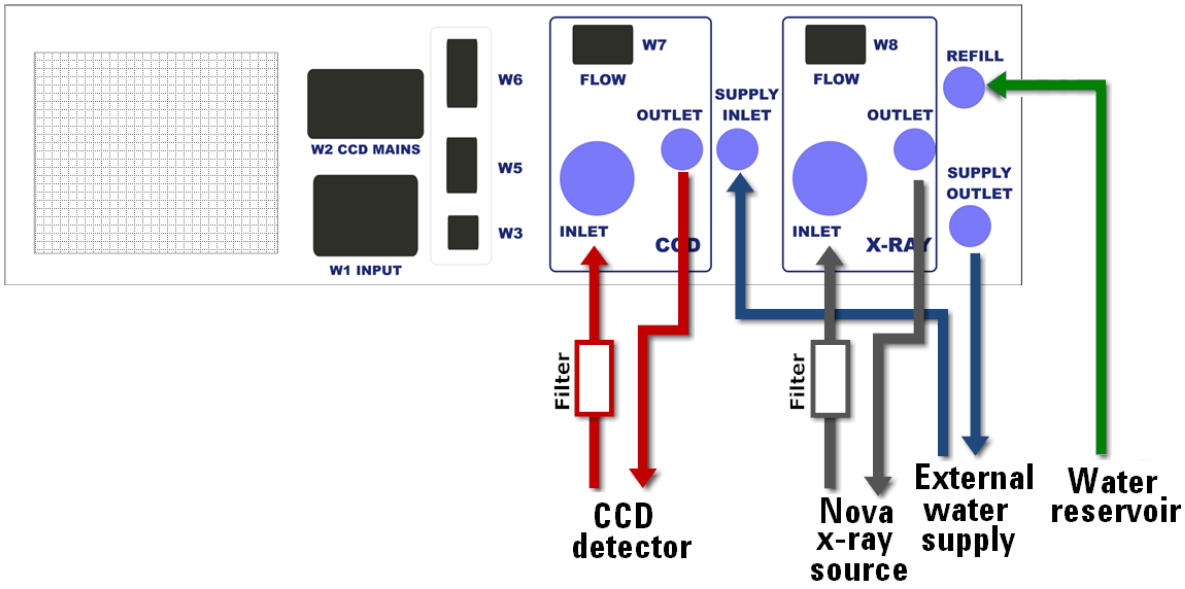
The Air Cooler water circuit is a closed loop. Water coming into the Supply Inlet on the back panel of KMW70 Water Cooler, passes through the external circuit of the unit, collects the heat and goes through Supply Outlet to Water Inlet in the Air Cooler circuit (see Fig. 3a). After returning the heat to the air, the water is delivered through the Air Cooler Water Outlet to KMW70 Water Cooler. The flow rate in this external circuit is constant. The Refill connector in this mode of operation is corked. The Air Cooler is connected to the W6 socket to control its pump and to read from its sensors.

- **Water-to-water mode:**

The external water coming into the Supply Inlet on the back panel of KMW70 Water Cooler, passes through the external circuit of the unit, collects the heat and goes through Supply Outlet to the drain or external closed water circuit (Fig. 3b). The flow rate in this external circuit is controlled by a proportional valve. It consumes ca. 0.3 l/m. The Reservoir is connected to the Refill connector on the back panel of KMW70 Water Cooler. Water pump is turned on after start up and works for 30 s. The Reservoir is connected to W6 socket to control its pump and to read from its sensors.



a)



b)

Figure 3 Network of water connections in a) water-to-air mode and b) water-to-water mode

3.2.2 Internal water circuit

The rear panel of the unit contains internal inlet and outlet points. Both modules' inlet pipes contain flow sensors mounted externally on the rear panel. These are mounted in such a way, that the axis of rotation is horizontal (see Fig. 4). The flow sensors pipes and hoses connections should be fitted with o-rings and screwed properly. The flow sensors' cables are connected to sockets W7 (for CCD) and W8 (for X-ray) on the rear panel, using the plugs provided.

The unit will pump water to the device to be cooled. Water returning from the device should first pass through an inline filter (see Fig. 5) before re-entering the unit at the inlet point (through the flow sensor). The separately mounted water distribution panel contains two filters (one for each module).

To clean the inline water filters turn off the KMW70 unit using the button at the front panel. Unscrew the proper filter cap (see Fig. 5). Mind the liquid leakage. Remove the filter inside and clean it. When replacing it, be sure to fit it correctly and replace the cap with the o-ring in place.

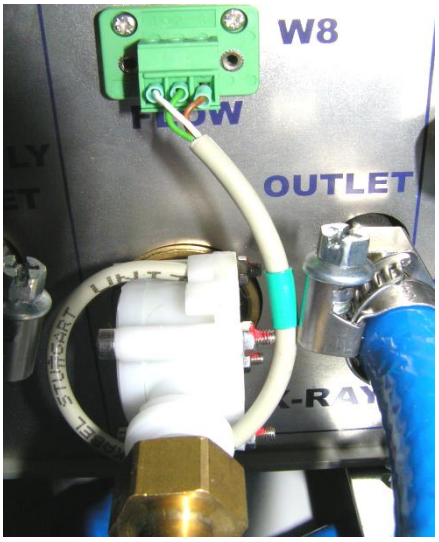


Figure 4 Flow sensor (on X-ray side) correct mounting position and its connection to W8 socket

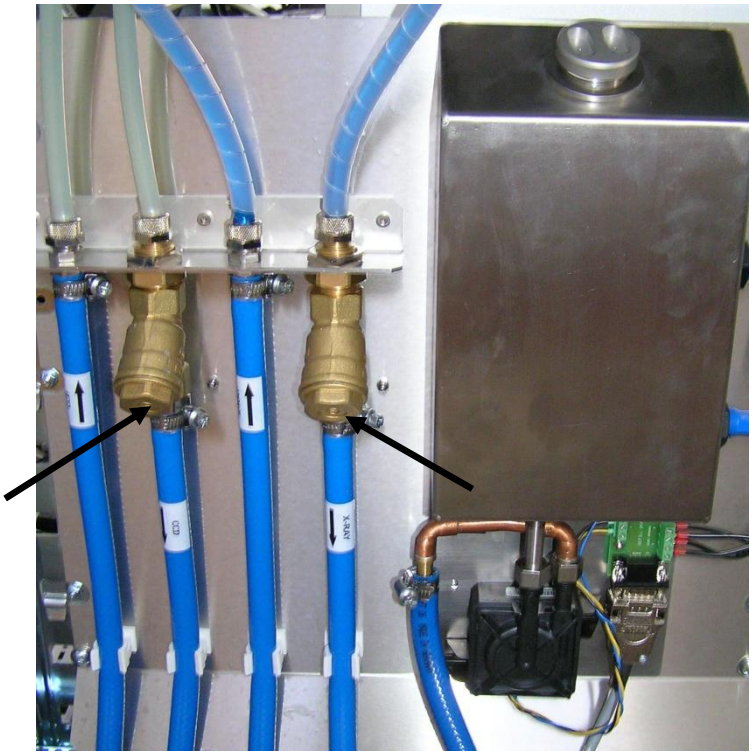


Figure 5 Photograph of water distribution panel and the Reservoir. Arrows point inline water filter caps

3.2.3 Other connections

The rear panel of the unit contains two sockets for the flow sensors. These sensors are connected to the W7 and W8 outputs. The W5 output is an interlock connection socket. It outputs a signal when the X-ray source module is operating normally (i.e. cooling water is flowing through the X-ray source within normally operating limits). This cable should be connected to the X-ray generator safety interlock system (described in a separate manual). If cooling water flow is interrupted then the lack of the signal in this cable will result in the power to the X-ray source being shut off to prevent overheating.

The W6 socket is the connection between the KMW70 Cooler and the Air Cooler or Reservoir, depending which option is being used.

3.2.4 Mains output

The unit contains a mains voltage output (labelled W2) on the rear panel. This is intended to power the CCD detector. A cable should be connected from this outlet to the power supply unit of the detector. Thus, mains voltage is output on this socket when the CCD module of this unit is operating normally (ie. cooling water is flowing through the CCD detector within normal operating limits). If cooling water flow is interrupted then the power to the detector is shut off to prevent overheating.

3.2.5 Ethernet

This unit includes Ethernet connection socket (labelled W3) on the back panel. The connection allows both reading and setting of operating parameters. The modules can be remotely controlled by making connection to the IP address or by starting ODBench control windows in CrysAlis™ software. Remote control is described later in this manual.

3.3 Water distribution panel

The water distribution panel is supplied with an Agilent Technologies diffractometer if it includes a KMW70 Water Cooler (either water-to-air, or water-to-water heat exchangers). The panel provides a mounting location for in-line water filters on the internal circuits (see Fig. 5) and the Reservoir used in water-to-water mode.

4. Operation

4.1 Front panel

The front panel contains one power on/off switch for both modules (X-ray source and CCD detector). There is a set of warning/error status LEDs for each module. The modules are fully automatic both during start-up and during normal operation. Water temperature limits for the two modules have been independently set inside the unit and are not adjustable by the user.

The front panel has two green LEDs (see Fig. 6 and 7) associated with each of the modules (X-ray and CCD). When the green LED is shining it means that the module is operating. If the green LED is not shining it means that the module has been stopped (this is only possible under remote software control).

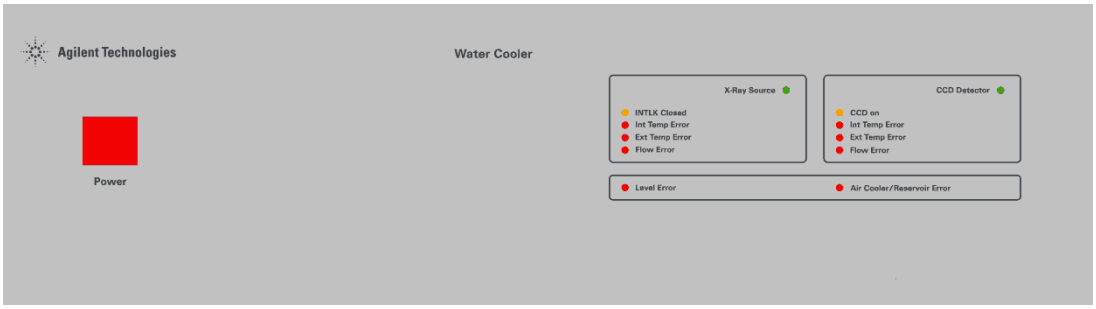


Figure 6 Front panel of KMW70 Water Cooler

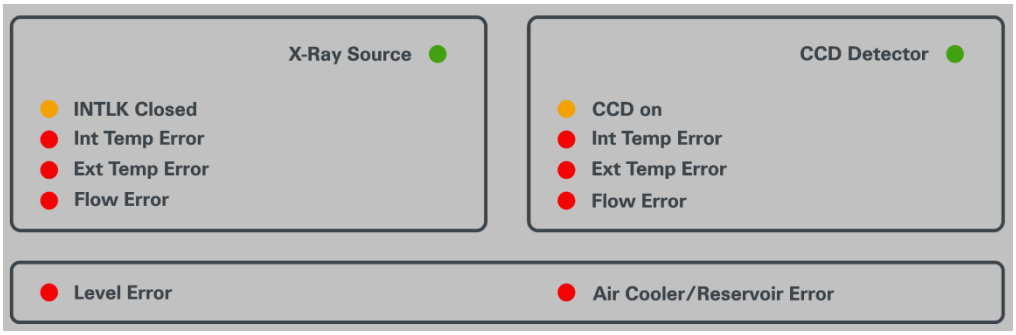


Figure 7 Front panel LEDs

4.1.1 Error/warning status LEDs

The error states shown by the LEDs are: Internal Temperature, External Temperature, Flow, Level, Air Cooler/Reservoir. Error (red) LEDs do not shine during normal operation. During normal work only orange (INTLK Closed and CCD on) LEDs shine. Figure 10 shows these LEDs.

The Internal Temperature LED shines if the temperature of the internal circuit water is outside of its normal limits. The LED blinks in case of warning. It means, that the internal water temperature approaches its maximum.

The External Temperature LED shines if the temperature of the external circuit water is outside of normal limits. This LED blinks in case of warning, which means approaching to maximum values.

The Flow error LED shines if the coolant cannot flow in the internal circuit. Blinking means that the flow rate is reduced.

The Level error LED shines if there is insufficient water in the Air Cooler or Reservoir.

The Air Cooler/Reservoir error LED shines if there is no connection between KMW70 and the Air Cooler or Reservoir.

4.2 Starting up the unit

Both modules are started simultaneously by pressing the power switch on the front panel. During the start-up phase all error status LEDs will be illuminated. When they are turned off that module of the unit is operating normally.

Only when start-up has completed successfully the CCD detector will be supplied with power (from the CCD module), and the “flow acknowledge” signal from the X-ray module will appear.

4.3 Remote control by the software

The KMW70 Water Cooler can be controlled by the CrysAlis Pro software ODBench plugin.

To open the ODBench control window, in CrysAlis Pro click the Command Line icon on the left menu and in the text line type “odbench” acknowledged by pressing Enter. Sample of advanced view of this software is presented in Fig. 8.

Figure 8 ODBench control window

ODBench control window contains separate tabs for the CCD and X-ray modules. Both of these show current internal and external temperatures, cooling powers and flow rates of the coolant through the modules. Set values, limits and current error/warning statuses are also printed in advanced view of the window.

5. Troubleshooting

Problem	Cause	Action
Unit cannot be turned on from the front panel	Mains power is not connected	Connect mains power at the rear panel.
Level error LED lights after switching on module	Air Cooler/Reservoir water level is too low	Fill the Air Cooler/Reservoir with coolant (solution of 90% distilled water and 10% of glycol).
Flow error LED lights after switching on module	Some air bubbles remain in the water circuit	Turn off and on the device. If needed, repeat the procedure a few times to get rid of the air in hoses and pipes.
Flow error LED flashes during operation	Liquid cannot flow through the internal circuit (through CCD detector or X-ray source)	Check if the hoses are properly connected and valves are open. Check if the filter is not blocked and clean it if necessary.
Air Cooler/Reservoir error LEDs lights	Air Cooler/Reservoir power or signal cable is not connected	Turn off the KMW70 Water Cooler power supply at the front panel. Connect Air Cooler/Reservoir signal cable to the unit and the power supply cable to the back panel of the system. Turn on the unit.
Int/Ext Temp Error LED lights	Liquid in the circuit is too hot	a). In water-to-air mode, reduce the air temperature in the room below 25 deg. C. Provide good air flow space around the Air Cooler b). In water-to-water mode, reduce the temperature of water in the external circuit.

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